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BIOLOGICAL STUDIES ON *RH ABDOSARGUS HAFFARA* (TELEOST; SPARIDAE) FROM ARABIAN GULF OF DAMMAM, SAUDI ARABIA

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ABSTRACT

Age and growth were investigated for *Rhabdosargus haffara* collected from Arabian Gulf water off Dammam City, Kingdom of Saudi Arabia. Length-scale relationship was found to be linear (T.L= 7.62 + 15.43S). V.B.G. parameters were estimated and found to be, L∞ = 27.74 cm, W∞, 399.95 gm, K = 0.17 per year and T_0 = -1.85 year. Growth performance, Φ = 2.12 and maximum age was computed as 15.82 year. Length-weight relationship was found to be slightly allometric with constants a = 0.013 and b = 3.11. ($w=aL^h$) Sex ratio was in the favor of females outside the spawning season, while males were dominant during the spawning season. Natural mortality was estimated and found to be 0.68 per year.

1. INTRODUCTION

R. haffara is a sparid fish, which is distributed in the Arabian Gulf, Indian Ocean & the Red Sea. The biology & biological relations of this species need further studies. Few authors have done same research on the growth & reproduction of this species, in the Red Sea. Ahmed & El-Ganainy (2000), El-Boray (2001), and Mehanna (2001) made some studies on growth & reproduction of this species in the Suez Canal, Red Sea. However in the Arabian Gulf no work is published in this concern, in the available literature. In the following a preliminary study on the age & growth of this species is attempted.

2. MATERIALS & METHODS

Sampling: Fish specimens used in the present study were collected along the coasts of Dammam city Arabian Gulf (Kingdom of Saudi Arabia). Monthly fish samples were collected during the period from January to December 2002 from commercial catch where the number of sampled fish was about 45º specimens. Fish were measured for total length, from the tip of the snout to the end of the caudal fin, to the nearest 1 mm & weighed to the the nearest 0.1 gm (gutted weight) was recorded. Scale samples were taken from the right side between the lateral line & dorsal fin where about eight scales were sampled and cleaned for age determination.

2.1. Growth parameters:

The relationship between gutted weight (wt in gm) and total length (Lt in cm) can represent by the logarithmic equation as follows;

$$\text{Log10W} = \text{Log } a + b \text{ Log Lt}$$

Where, a: is the intercept.
b: is the slope. (Anderson and Neuman, 1996).
Length scale relationship and back-calculated lengths were calculated according to.Lee (1920)

$$L = a+bS$$

Where, L= total length of the fish
S = scale radius in micrometer division
a&b are constants.
The V.B.G. F, was fitted to back calculated lengths

$$L_t = L_\infty[1- e(-k(t-t_0))]$$

Where Lt: predicated length at time (t).
L_∞: asymptotic length.
K: growth coefficient.
t_0: theoretical (age) when length was zero (Von Bertalanffy 1938, Ricker 1975)
V.B.G.M was estimated for total body weight as a function of age, by using the value of b (obtained by the length weight relationship).

$$W_t = W_\infty[1-e(-k(t-t_0))]^b$$

2.2. Natural mortality

Natural mortality was computed according to Pauly (1980)

3. RESULTS

3.1. Length scale radius relationship

Length scale relationship was found to be linear as shown in (Fig. 1) where the following equation was found to fit the observed data,

$$L = a + bS$$

Where a and b are constant.
The equation obtained is as follows:

$$T.L = 7.62 + 15.43S \quad r^2 = 0.65$$

Where T.L is the total fish length in cm
S is the scale radius in micrometer divisions, the back calculations of lengths was done according to Lee (1920)

3.2. Theoretical linear growth

Back calculated lengths of the studied species, at the end of each year of life were used to fit the Von Bert Growth Model (V.B.G.M.)

Calculation of the parameters of such model gave the following equation:-

$$L_t = 27.74[1-e^{(-0.17(t+1.85))}]$$

Table (2) shows the back-calculated lengths, as obtained by V.B.G.M, the theoretical maximal length 27.74 cm seems to be reasonable, since it is more than the biggest length observed.

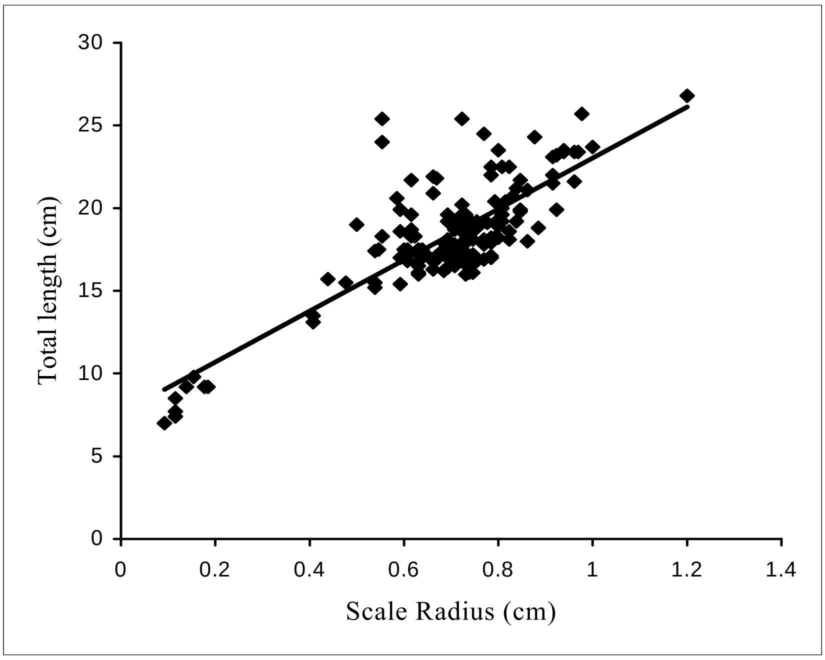

Fig. (1): Length scale relationship of *Rabdosargus haffara,* Arabian Gulf.

Table (1): Back calculated lengths at each year of life of *Rhabdosargus haffara* Arabian Gulf (2002)

Age (year)	Length (cm)
I	10.38
II	13.29
III	15.61
IV	17.11
V	18.41
VI	20.14
VII	21.54

Table (2): Theoretical lengths of *Rabdosargus haffara* according to V.B.G.M.

Age (years)	T.L (cm)	Age (years)	T.L (cm)
I	10.68	V	19.10
II	13.35	VI	22.32
III	15.60	VII	21.59
IV	17.5		

3.3. Growth in weight

L/wt relationship

Computation of length weight relationship is important for estimating ponderal fish growth.

This relationship for combined sex was found to be,

$$\text{Log } W = -1.88 + 3.11 \text{Log } T.L \quad r^2 = 0.97$$

Where W: is the gutted weight of the fish in gm & T.L. is the total length of the fish in cm.

The length weight relationship is graphically represented in Figure (2). The average weight values at the end of each year of life are given in Table (3). It can be pointed out that the weight increment is very low by the end of the first year & increases gradually with age reaching its maximum value by the sixth year. The calculation of theoretical growth in weight according to V.B.G.F., The parameters of this formula were computed according to Ford – Walford (1933)

$$Wt = W\infty[1-e^{(-k(t-t0)}]^b$$

Where Wt: is the length of the fish at age t years

$W\infty$: the asymptotic weight of the fish.

K = the growth parameter

T_0: a value corresponding to fish wt at age zero

b: the exponent in the length weight relationship

The V.B.G.F for growth in weight is as follows:

$$Wt = 399.95[1-e^{(-0.17(t-:1.86)}]^{3.11}$$

The results of computations of the back-calculated weights according to this formula are given in Table (3)

Table (3): Hypothetical weights according to V.B.G.M for *Rhabdosargus haffara*, Arabian Gulf.

Age (years)	Weight (gm)	Age (years)	Weight (gm)
I	20.56	V	125.25
II	41.11	VI	154.92
III	66.74	VII	183.39
VI	95.39		

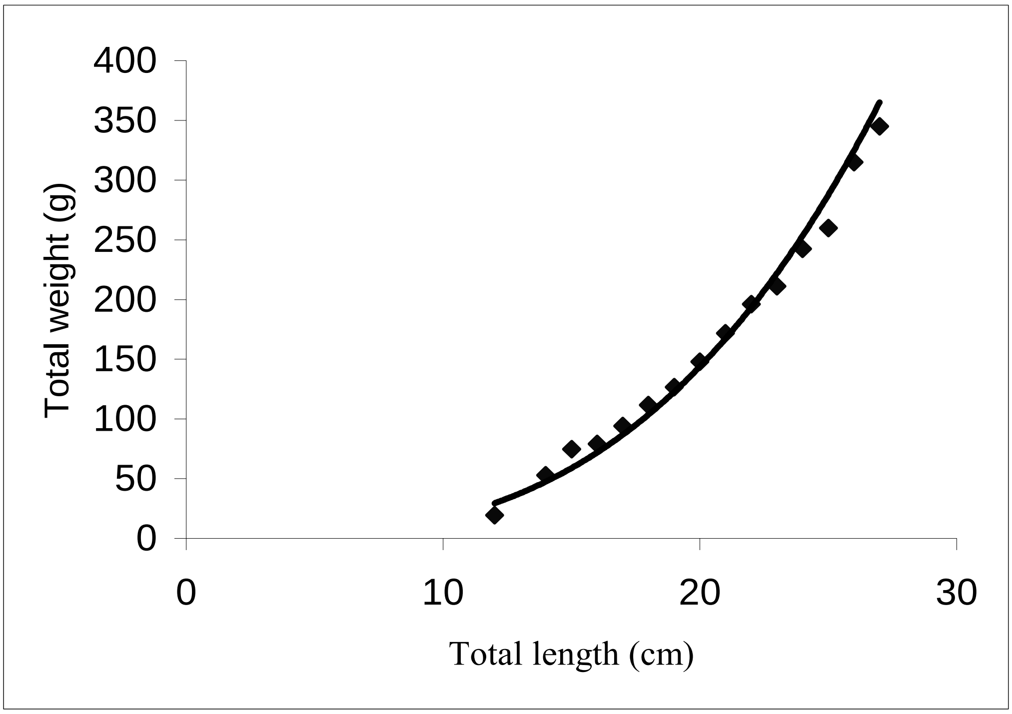

Fig. (2): Length weight relationship of *Rabdosargus haffara*, Arabian Gulf

3.4. Condition factor

In the present study, Fulton's condition factor; was calculated for the whole sample without segregation of sexes (Table 4). The mean condition factor was found to be 1.751 for all length groups. It appears that the condition factor, increases with fish length after which a decrease also was found at total lengths more than 22 cm.

3.5. Growth performance

The growth performance of the species under the present study was done using the equation $\Phi = 2 \text{ Log } L\infty + \log K$ (Pauly, 1980) where the value of Φ was found to be 2.12

3.6. The maximum age

This was computed according to the formula

Max age = $3/k + t_0$

This was found to be 15.82 years

3.7. Sex ratio

Table (5) shows the monthly variations in sex ratio. It is apparent that, outside the spawning season the sex ratio is in favour of females while inside the spawning season the males dominate the population.

If we consider the whole sample collected from January to December, it appears that the sex ratio is in favour of females.

3.8. Spawning season

It can be noticed from figure (3), that the GSI for both sexes increase in December, January, February and March – these months therefore constitute the season of spawning for these species.

3.9. Natural mortality

Natural mortality as estimated according to Pauly (1983) was found to be 0.68 per year

4. DISCUSSION

Age determination of tropical fish species is considered as one of the tasks that need high care in scale interpretation. Various authors have discussed this problem and the presence of annual checks on hard parts in most tropical fish species have been studied (Pauly, 1980). Scales in the species understudy are of the ctenoid type, various false checks have been observed together with some replaced or unreadable scales.

Studies on *R. Haffara* in the area of study concerned with the study of the biology of some species in the Red Sea (Suez Canal), Mehanna (2001), El-Boray. (2001). However it was difficult to find detailed inform attains about the biology of these species in the Arabian Gulf. In the present study, the asymptotic length of *R. haffara* was found to be 27.74 cm & k value was k = 0.17. Mehanna (2001) gave a value for L∞ close to that in the present study (26.79 cm) while the value of k was found to be 0.47.

It is obvious therefore that the value of k for *R. Haffara* is lower in the Arabian Gulf than in the Red Sea.

According to Pauly's equation for natural mortality the value of natural mortality M was found to be 0.68 per year, this value is higher than that in Suez Canal Pauly (1980) had reviewed natural mortality rates for 175 fish stocks & found that they ranged between 0.2 & 0.3 mostly. This shows that the natural mortality of this species in the Arabian Gulf is much higher than given by Pauly.

The exponent of L/wt relationship was found to be 3.11. This means that the growth in weight in this species tends to be slightly allometric. In the Red Sea the value of the exponent was found to be 2.94, which is lower than that in the present study.

Geographic locations & associated environmental conditions, such as seasonality feeding, pollution problems or disease is expected to affect the value of this exponent (Le Cren, 1951)

It was observed that the monthly variations in the value of condition factor were in significant. The value of C was found to decrease with length. The value of W∞ was found to be 399.95 gm. This shows a higher asymptotic weight of this species than in the Red Sea. It is a matter as fact that difference in growth among the same species in two different geographic localities could that be attributed to changes in geographical distribution & temperature, which is always higher than 17 Cº in the Arabian Gulf, Variations in the different biometric & biological factors between the same species in Suez Canal & Arabian Gulf are therefore expected.

Longevity of this species is about 15.82, which is also higher than in the Red Sea, while the growth performance index for growth in length Φ obtained here was 2.12, which is lower than that obtained for the same species in Suez canal (Mehanna, 2001).

Table (4): Condition factor of *Rhabdosargus Haffara* in the Arabian gulf off Dammam, kingdom of Saudi Arabia.

T.L (cm)	Fulton's condition Factor	T.L (cm)	Fulton's condition Factor
12	1.02	16	1.9
13	1.07	17	1.89
14	1.76	18	1.88
15	2.095	19	1.86

Table (5): Monthly variations in sex ratio, for *Rhabdosargus Haffara* along the coasts of Dammam, Arabian Gulf, kingdom of Saudi Arabia.

Month	Mals& females	Total	S.R
Jan	17:25	42	1:1.5
Feb	25:15	40	1.5:1
March	21:17	38	1:.86
April	14:22	36	1:1.5
May	10:29	39	1:2.7
June	14:21	35	1:1.5
July	12:24	36	1:2
August	12:64	76	1:5
September	23:47	70	1:2
October	14:15	29	1:1
November	64:18	82	3.3:1
December	60:20	80	3:1
Total	183:299	603	0.6:1

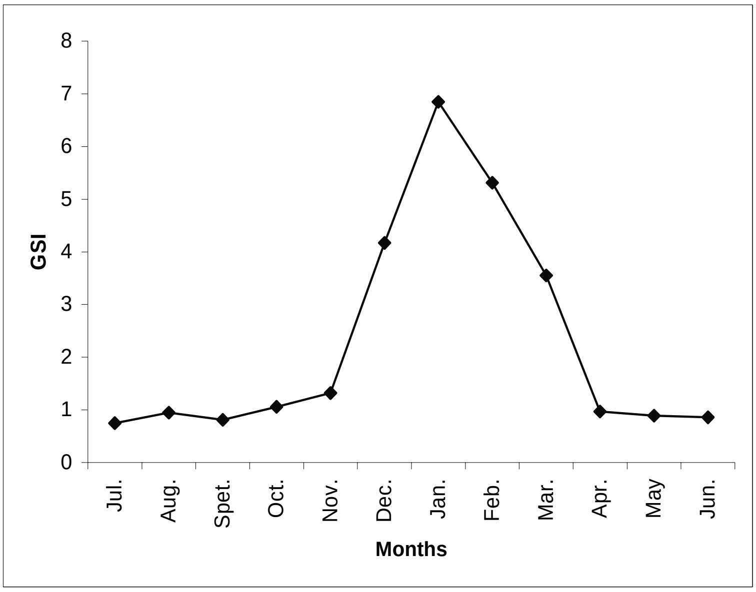

Fig. (3): Monthly variations in gonad somatic index (GSI) for *Rabdosargus haffara*, Arabian Gulf

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